

# JAPAN

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JIS K 6770 (1991) (English): Crosslinked  
polyethylene (PE-X) pipe fittings

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*The citizens of a nation must  
honor the laws of the land.*

Fukuzawa Yukichi

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# JIS

## JAPANESE INDUSTRIAL STANDARD

Crosslinked polyethylene  
(XPE) pipe fusion fittings

JIS K 6770—1991

Translated and Published

by

Japanese Standards Association

In the event of any doubt arising,  
the original Standard in Japanese is to be final authority.

UDC 621.643.411:621.643.2-036.5:678.742.2

## JAPANESE INDUSTRIAL STANDARD

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Crosslinked polyethylene (XPE) pipe  
fusion fittings

K 6770-1991

1. Scope

This Japanese Industrial Standard specifies the insertion fittings (hereafter, referred to as fittings) capable of fusion joining in which heating elements such as heating wire or the like to be used for joining pipes of class 2 (hereafter, referred to as pipes) specified in JIS K 6769 are incorporated.

Remarks 1. Applicable standards in this Standard shall be given as follows.

JIS B 0202-Parallel Pipe Threads

JIS B 0203-Taper Pipe Threads

JIS B 0253-Gauges for Taper Pipe Threads

JIS B 0254-Screw Thread Limit Gauges for Parallel pipe Threads

JIS B 1002-Dimensions of Width Across Flats

JIS B 7150-Micrometer Microscopes

JIS B 7502-Micrometer Callipers for External Measurement

JIS B 7507-Vernier Callipers

JIS H 3250-Copper and Copper Alloy-Rods and Bars

JIS H 5101-Brass Castings

JIS H 5111-Bronze Castings

JIS K 6769-Crosslinked Polyethylene (XPE) Pipes

JIS K 6775-Polyethylene Pipe-fittings for the Supply of  
Gaseous Fuels

JIS K 7113-Testing Method for Tensile Properties of Plastics

JIS Z 8401-Rules for Rounding off of Numerical Values

2. The units and numerical values given in { } in this Standard are based on the traditional units and are appended for informative reference.

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Reference Standards: See page 10.

## 2. Performance

The performance of fittings, when the fittings are tested in accordance with 7., shall conform to the requirements specified in Table 1.

Table 1. Performance

Performance item			Performance	Test temperature	Applicable test clause
Ring tensile yield strength			13.5 MPa {138 kgf/cm <sup>2</sup> } min.	23 ± 2°C	7.3
Hydraulic pressure resistance	Method A <sup>(1)</sup> (0.02 MPa {0.2 kgf/cm <sup>2</sup> })		To be free from leak and other defects.	20 ± 15°C	7.4
	Method B (2.5 MPa {25.5 kgf/cm <sup>2</sup> })				
Hot internal pressure creep performance	1 h creep		To be free from leak and other defects.	95 ± 2°C	7.5
	8000 h creep			110 ± 2°C	
Tensile rupture			Pipe shall be ruptured.	23 ± 15°C	7.6
Compression peeling			The peeling length rate of a fusion joint part shall be 15 % max.	23 ± 2°C	7.7
Elusion property <sup>(2)</sup>	Turbidity		0.5 degree max.	Unless otherwise specified, ordinary temperature	7.8
	Chromaticity		1 degree max.		
	Consumption of potassium permanganate		2 mg/l max.		
	Loss of residual chlorine	Test water at ordinary temperature <sup>(3)</sup>	0.7 mag/l max.		
		Test water at 95 ± 2°C <sup>(4)</sup>	1 mg/l max.		
	Odor and taste		To be free from abnormality.		
Gel content			65 % min.	—	7.9

Notes (1) Method A shall apply in the case where a metallic fitting is used simultaneously.

(2) The numerical value of the elusion property or the like shall be obtained by a difference from the value with blank test water.

(3) "The test water at ordinary temperature" means the case of an elusion test with test water at ordinary temperature.

(4) "The test water at  $95 \pm 2^\circ\text{C}$ " means the case of an elusion test with test water at  $95 \pm 2^\circ\text{C}$ .

### 3. Appearance

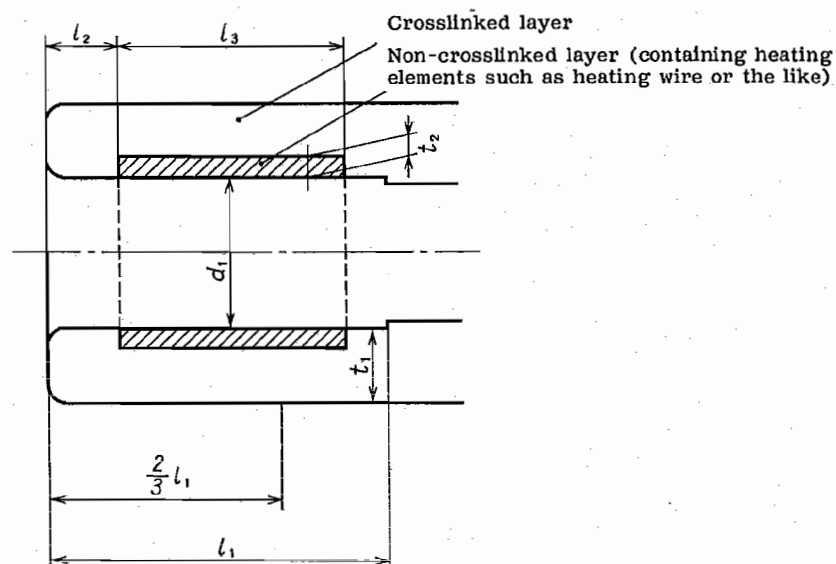
The appearance of fittings shall be smooth on the outside and inside surfaces and free from the flaws and cracks which are detrimental to use.

### 4. Shape, Dimensions and Tolerances on Dimensions

4.1 The section of the joint of fittings shall be practically true circle, and both end surfaces thereof shall be normal to the axis of the fittings.

4.2 Common dimensions of the joint of fittings and tolerances on dimensions shall be as given in Fig. 1.

Fig. 1. Common Dimensions of the Joint and Tolerances on Dimensions





4  
K 6770-1991

Fig. 1. (Continued)

Unit: mm

Nominal diameter	$d_1^{(5)}$	Tolerance on $d_1$	$l_2^{(6)}$	$l_3^{(6)}, (7)$	$l_1, (8)$	Nominal designation of screw thread at installing end part ( <sup>9</sup> ) R, Rc, G	Informative Reference	
							$l_2$	$l_1$
5	8.1	$\pm 0,10$	3	13	4.0	$\frac{1}{8}$ $\frac{1}{4}$ $\frac{3}{8}$	0,5	19
7	10.1					$\frac{3}{8}$  $\frac{1}{2}$		
8	11.1							
10	13.1	$\pm 0,15$	4	13	$\frac{1}{2}$		20	
13	17.1			15		22		
15	20.1			16		23		
16	21.6		5	18	4,8	$\frac{1}{2} \frac{3}{4}$	28	
20	27.3					1	30	
25	34.4	$\pm 0,20$				20	$1 \frac{1}{4}$	33
30	42.4					23	$1 \frac{1}{2}$	36
40	48.4					24	2	
50	60.5		28		41			

Notes (<sup>5</sup>) Tolerances on  $d_1$  size shall apply to a part in which heating elements such as heating wire or the like are incorporated.

(<sup>6</sup>)  $l_2$ ,  $l_3$  and  $l_1$  are the minimum sizes.

(<sup>7</sup>)  $l_3$  size is the size of a part in which heating elements such as heating wire or the like are incorporated.

(<sup>8</sup>)  $l_1$  size shall apply to all parts other than a range of  $\frac{2}{3}l_1$  from the fittings end part.

(<sup>9</sup>) The nominal designation of the installing end part shall apply to the case where a threaded portion exists (see Informative Reference Figs. 6 to 9).

Informative Reference:  $t_2$  is a thickness including a non-crosslinked layer and a heating wire.

Remarks 1. The threaded portion shall be as specified in JIS B 0202 and JIS B 0203.

2. The size of a width across flat shall be in accordance with Attached Table 1 of JIS B 1002.

Informative Reference: For the shape and dimensions classified by the type of fittings, see Informative Reference.

## 5. Colour of Fittings

The colour of fittings shall be as agreed upon between the parties concerned with delivery. However, different colours shall be used so that a non-crosslinked layer and a crosslinked can be classified.

## 6. Materials

**6.1 Materials of Non-Metallic Part of Fittings** Materials of the non-metallic part of fittings shall be principally polyethylene and for addition agents such as stabilizer, lubricant, etc., cadmium one and lead one shall not be used.

Further, the same polyethylene shall be used for both the non-crosslinked layer and the crosslinked layer.

**Informative Reference:** For details, see the reference given in the tail of JIS K 6769.

**6.2 Materials of Metallic Part of Fittings** Materials of a part coming in contact with water shall be those specified in JIS H 5101, JIS H 5111 or JIS H 3250. Materials coming in non-contact with water shall be as agreed upon between the parties concerned with delivery.

## 7. Testing Methods

**7.1 Appearance and Shape** The appearance and shape shall be visually examined.

**7.2 Dimensions** Dimensions shall be measured by using micrometer callipers for external measurement specified in JIS B 7502, vernier callipers specified in JIS B 7507, gauges for taper pipe threads specified in JIS B 0253, and screw thread limit gauges for parallel pipe threads specified in JIS B 0254.

Further, the thickness of a non-crosslinked layer shall be measured by using micrometer microscopes specified in JIS B 7150, graduated magnifying classes, etc.

**7.3 Ring Tensile Test** The ring tensile test shall be performed in accordance with 6.8 of JIS K 6775. In that case, tensile speed shall be 50 mm  $\pm 10$  % per min.

### 7.4 Hydraulic Test

**7.4.1 Method A** Join a PN 15 class 2 pipe specified in JIS K 6769 of 250 mm or over in length to a test fittings by fusion, apply pressure of 0.02 MPa {0.2 kgf/cm<sup>2</sup>} to this inside with water at ambient temperature by an appropriate method, keep as it is for two min, and examine the presence of leak and other defects.

**7.4.2 Method B** Join a PN 15 class 2 pipe specified in JIS K 6769 of 250 mm or over in length to a test fittings by fusion, apply pressure of 2.5 MPa {25.5 kgf/cm<sup>2</sup>} to this inside with water at ambient temperature by an appropriate method, keep as it is for 2 min, and examine the presence of leak and other defects.

## 7.5 Hot Internal Pressure Creep Test

**7.5.1 1 h Creep Test** Join a PN 15 class 2 pipe specified in JIS K 6769 of 250 mm or over in length to a test fittings by fusion, fill the inside of the pipe with water, air, or nitrogen, and condition at  $95 \pm 2^\circ\text{C}$  for 1 h or longer. Thereafter, apply pressure of Table 2, keep temperature and pressure as they are for 1 h, and examine the presence of leak and other defects,

Table 2. Test Pressure of 1 h Creep Test

Unit: MPa{kgf/cm<sup>2</sup>}

Nominal diameter	Test pressure
5	1.99{20.3}
7	1.54{15.7}
8	1.38{14.1}
10	1.14{11.6}
13	1.20{12.2}
15	1.18{12.0}
16	1.20{12.2}
20	1.19{12.1}
25	1.17{11.9}
30	
40	1.16{11.8}
50	

**7.5.2 8000 h Creep Test** Excute this test only in the cases of change of raw materials or change of a manufacturing facility. Join a PN 15 class 2 pipe specified in JIS K 6769 of 250 mm or longer in length to a test fittings by fusion, fill the inside of the pipe with water, air, or nitrogen, and condition at  $110 \pm 2^\circ\text{C}$  for 1 h or longer. Thereafter, apply pressure given in Table 3, keep as it is for 8000 h, and examine the presence of leak and other defects.

Table 3. Test Pressure of 8000 h Creep Test

Unit: MPa{kgf/cm <sup>2</sup> }	
Nominal diameter	Test pressure
5	1.16{11.8}
7	0.90{ 9.2}
8	0.80{ 8.2}
10	0.67{ 6.8}
13	0.70{ 7.1}
15	0.69{ 7.0}
16	0.70{ 7.1}
20	
25	0.68{ 6.9}
30	0.69{ 7.0}
40	0.68{ 6.9}
50	

**7.6 Tensile Test** For a tensile test, join a PN 15 class 2 pipe specified in JIS K 6769 of 250 mm or longer in length to a test fittings by fusion, perform the tensile test at a speed of 50 mm  $\pm$ 10 % per min in accordance with JIS K 7113, and examine whether the pipe is ruptured or not.

Further, the gripping of a sample shall be in accordance with the following method.

- (1) In the case of Informative Reference Figs. 1 and 2 Grip pipes at both ends joined by fusion with a gripper.
- (2) In the cases of Informative Reference Figs. 3 to 5 and 9 Grip the pipes and fittings which are joined by fusion with a gripper so that the tensile direction becomes parallel to the longitudinal direction of the pipe.
- (3) In the case of Informative Reference Figs. 6 to 8 Grip the metallic parts of the pipes and fittings which are joined by fusion in the same way as in (2).

**7.7 Compression Peeling Test** The compression peeling test shall be performed in accordance with 6.12 of JIS K 6775.

**7.8 Elusion Test** The elusion test shall be performed on two kinds of tests such as the elusion test with test water at ambient temperature and the elusion test with test water at 95  $\pm$  2°C.

The elusion test method and the regulation method of test water shall be in accordance with Annex 2 (Measuring method for gel content rate of crosslinked polyethylene pipe) of JIS K 6769. In that case, the pipe in Annex 1 (Elusion test method of crosslinked polyethylene pipes) shall be read as the pipe fittings.

Further, the regulation method of sample water and blank test water shall be as follows. In that case, for the sample water and blank test water, shall be required 500 ml or over.

(1) Elusion Test with Test Water at Ambient Temperature

- (1.1) Use clean water at ambient temperature (city water or the like), and wash a test fitting or a test piece<sup>(10)</sup> at flow rate of 5 m or under per min for 1 h.

Note (<sup>10</sup>) The test piece shall be prepared by cutting appropriately the test fitting at need.

- (1.2) Then, rinse it with a suitable amount of test water once, and put into a hard glass container<sup>(11)</sup>. Put test water thereinto, hermetically seal with a water washed polyethylene film, intercept light, allow to stand still at ambient temperature for 24 h, and take this dipping water as sample water. In that case, take the surface area of the test fitting or test piece per 1 l of test water as a rate of 0.2 m<sup>2</sup>.

Note (<sup>11</sup>) Preliminarily wash a glass container to be used with nitric acid (1+15), and further wash with purified water.

- (1.3) At the same time, put test water into a same type hard glass container, hermetically seal by the same method as the regulation method of sample water, intercept light, allow to stand still at the same position as sample water, and take it as blank test water.

(2) Elusion Test with Test Water at 95 ± 2°C

- (2.1) Use clean hot water at 95 ± 2°C (heated city water or the like), and wash a test fitting or a test piece<sup>(10)</sup> at a flow rate of 5 m or under per min for 1 h.
- (2.2) Then, rinse that with a suitable amount of test water at 95 ± 2°C once, and put into a hard glass container<sup>(11)</sup>. Put test water at 95 ± 2°C thereinto, hermetically seal with a water washed polyethylene film, intercept light, allow to stand still at ordinary temperature for 24 h, and take this dipping water as sample water. In that case, take the surface area of the test fitting or the test piece to 1 l of test water as a rate of 0.2 m<sup>2</sup>.
- (2.3) At the same time, put test water in to a same type hard glass container, hermetically seal by the same method as the regulation method of sample water, intercept light, allow to stand still at the same position as sample water, and take that as blank test water.

**Informative Reference:** In one of expressions of concentration which are specified in 7.2 (expression of the concentration of liquid reagent and reagent solution) of JIS K 0050, "reagent ( $a+b$ ) means a mixture of  $a$  ml of reagent and  $b$  ml of water" is given. That is, nitric acid (1+15) means a mixture of nitric acid (of 60.0 to 71.0 % in concentration) and water by a rate of 1 to 15.

**7.9 Gel Content Test** The gel content test shall be performed as specified in 8.7 (gel content test) of JIS K 6769. In that case, the pipe in the prevision shall be read as the pipe fittings.

**7.10 Expression of Numerical Value of Test Result** Obtain the result of tests of 7.2 to 7.9 to a place of one figure more righthand than the last figure of a specific numerical value, and round off in accordance with JIS Z 8401.

## 8. Inspection

The inspection of fittings shall be classified into type inspection items<sup>(12)</sup> and delivery inspection items<sup>(13)</sup>. The tests shall be performed in accordance with 7. on the following (1) Type Inspection Items and (2) Delivery Inspection Items, and the results shall conform to the requirements specified in 2. to 5.

Further, the sampling inspection plan of the delivery inspection shall be as agreed upon between the parties concerned with delivery.

**Notes (<sup>12</sup>)** The type inspection means an inspection for judging whether the quality of a product conforms to all characteristics given by design or not.

**(<sup>13</sup>)** The delivery inspection means an inspection for judging whether the product by the same design and manufacture as those for the product preliminarily accepted by the type inspection conforms to characteristics considered necessary or not when delivered.

### (1) Type Inspection Items

- (a) Appearance and shape
- (b) Dimensions
- (c) Ring tensile yield strength
- (d) Hydraulic pressure resistance (method A and method B)
- (e) Hot internal pressure creep (1 h creep test and 8000 h creep test)
- (f) Tensile ruption
- (g) Compression peeling
- (h) Elusion property
- (i) Gel content

10  
K 6770-1991

(2) Delivery Inspection Items

- (a) Appearance and shape
- (b) Dimensions
- (c) Ring tensile yield strength
- (d) Hydraulic pressure resistance (method A and method B)
- (e) Hot internal pressure creep (1 h creep test)
- (f) Gel content

9. Marking

Fittings shall be marked by an indelible method on the outside of the fittings with the following items.

- (1) Nominal diameter
- (2) Year and month of manufacture or its abbreviation
- (3) Manufacturer's name or its abbreviation

10. Precautions on Safety Use

Precautions on safety use which contain the following description shall preferably enter a pamphlet or the like.

- (1) Fittings shall be reserved indoors. In the case of outdoors, direct rays of the sun shall be avoided.
- (2) In the case of outdoor exposed piping, an outside coat film shall be processed lest the fittings should be exposed by direct rays of the sun.
- (3) Fittings shall be suitably protected. An insecticide, an antiseptic substance (creosote oil or the like), a white ant insecticide, etc. shall not be directly sprayed or coated on the fittings.

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Reference Standards:

JIS B 2354-Crosslinked Polyethylene (XPE) Pipe Clamp Type Fittings

JIS K 0050-General Rules for Chemical Analysis

JIS K 6763-Polyethylene Pipe Fittings for Water Works

JIS K 6777-Chlorinated Polyvinyl Chloride (CPVC) Pipe Fittings for Hot and Cold Water Supply

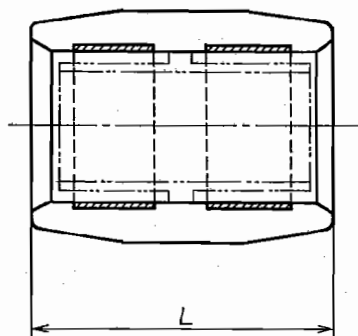
JIS K 6779-Polybutene (PB) Pipe-Fittings

JIS Z 8203-SI Units and the Use of their Multiples and of Certain other Units

# Informative Reference Classification of Fitting Shapes and Dimensions other than Common dimensions of Joint Parts of Fittings

This Informative Reference supplements matters related to provisions in body and is not a part of the provisions.

Informative Reference Fig. 1 Socket



Unit: mm

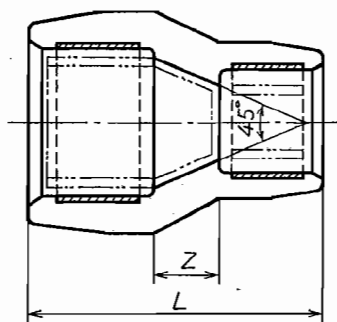
Nominal diameter	<i>L</i>
5	38
7	
8	
10	40
13	44
15	46
16	
20	56
25	60
30	66
40	72
50	82

- Remarks 1. A socket is used for fusion joining of pipes of a same nominal diameter.
2. The two dot chain line part in the Figure is a mechanism for holding the inside of a pipe in fusion, which occasionally applies to pipes of small wall thickness (Ditto for Informative Reference Figs. 2 to 9).



12  
K 6770-1991

Informative Reference Fig. 2. Reducer

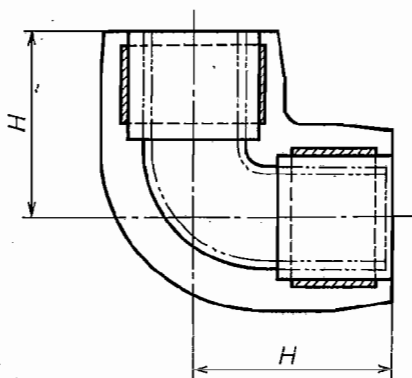


Unit: mm

Nominal diameter	<i>L</i>	<i>Z</i>
13× 8	45	4
13× 10	46	
15× 13	49	
16× 13		
20× 16	51	6
25× 20	65	7
30× 25	71	8
40× 30	75	6
50× 40	89	12

Remarks: The reducing socket is used for fusion joining of pipes of different nominal diameters.

Informative Reference Fig. 3. Elbow

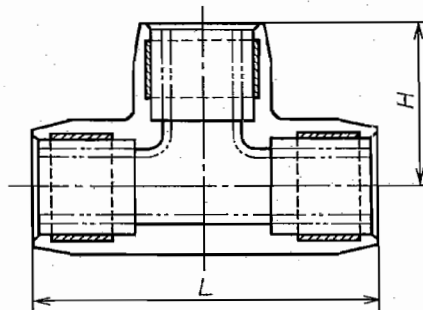


Unit: mm

Nominal diameter	<i>H</i>
10	31
13	35
15	37
16	38
20	46
25	52
30	60
40	67
50	80

Remarks: An elbow is used for fusion joining of bend piping part.

Informative Reference Fig. 4. Tee



Unit: mm

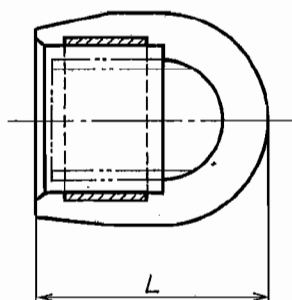
Nominal diameter	L	H	Nominal diameter	L	H
10×8	61	30	25×16	104	45
10×10		31	25×20		50
13×8	69	32	25×25		52
13×10		33	30×20	120	55
13×13		35	30×25		57
15×10	74	34	30×30		60
15×13		36	40×25	134	61
16×10	76	35	40×30		64
16×13		37	40×40		67
16×16		38	50×30	159	72
20×13	91	40	50×40		75
20×16		41	50×50		80
20×20		46			

Remarks: A tee is used for fusion joining of a branch piping part.

14  
K 6770-1991

Informative Reference Fig. 5. Cap

Unit: mm

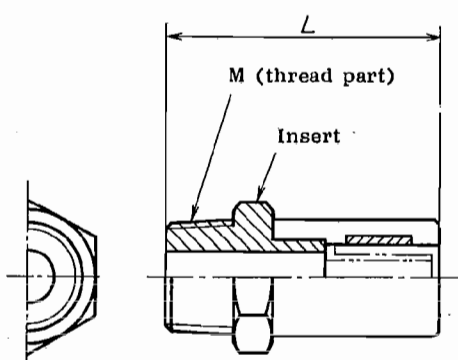


Nominal diameter	L
5	23
7	
8	
10	24
13	26
15	27
16	
20	32
25	35
30	39
40	43
50	50

Remarks: A cap is used for fusion joining of a pipe end treating piping part.

Informative Reference Fig. 6. External Thread Socket

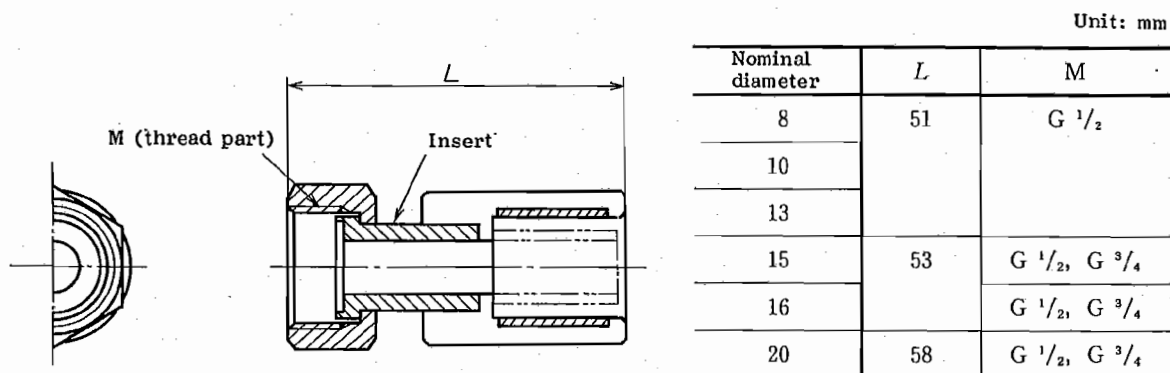
Unit: mm



Nominal diameter	L	M
8	49	R 1/2
10		
13		
15	53	R 1/2, R 3/4
16		R 1/2, R 3/4
20	58	R 1/2, R 3/4

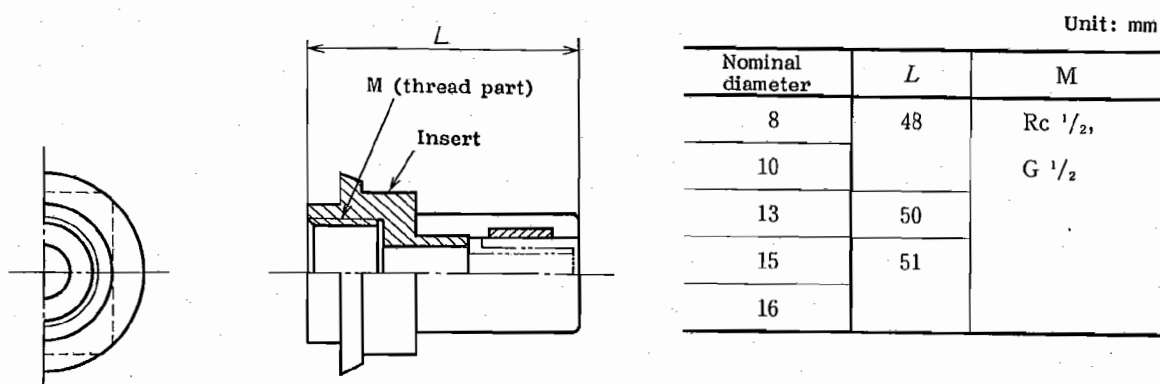
- Remarks 1. An external thread socket is used for joining of a crosslinked polyethylene pipe class 2 to the internal thread of another class pipe or an apparatus.
2. The thread part M shall be the taper pipe external thread specified in JIS B 0203.

Informative Reference Fig. 7. Union Socket



- Remarks 1. A union socket is used for joining of a crosslinked polyethylene pipe class 2 to the external thread of another class or an apparatus.
2. The thread part  $M$  shall be the parallel pipe internal thread specified in JIS B 0202, and a packing is jointly used.

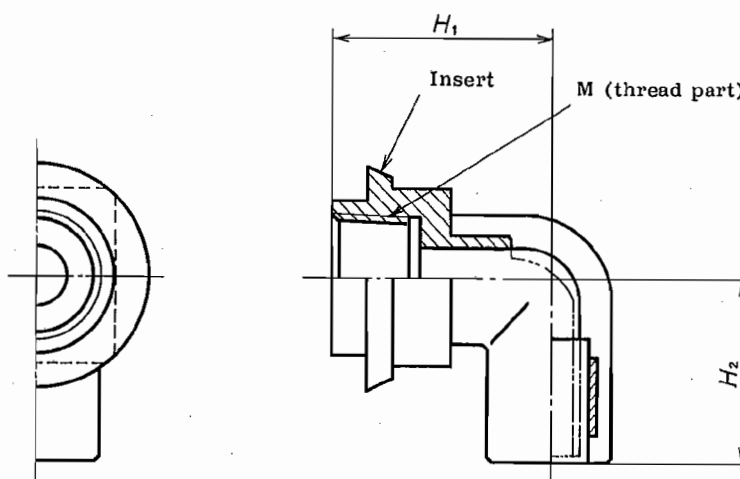
Informative Reference Fig. 8. Sockets for Faucet and Joint



- Remarks 1. Sockets for faucet and joint are used for joining by threads of a faucet and other class pipe.
2. The thread part  $M$  shall be the parallel pipe internal thread of JIS B 0202 or the taper pipe internal thread of JIS B 0203.
- Further, when the parallel pipe internal thread is used, a packing is jointly used.

16.  
K 6770-1991

Informative Reference Fig. 9. Elbows for Faucet and Joint



Unit: mm

Nominal diameter	$H_1$	$H_2$	M
8	34	30	Rc $\frac{1}{2}$ ,
10			G $\frac{1}{2}$
13		32	
15		33	
16			

- Remarks 1. Elbows for faucet and joint are used for joining by threads of a faucet and a bend piping part of another class pipe.
2. The thread part M shall be the parallel pipe internal thread of JIS B 0202 or the taper pipe internal thread of JIS B 0203.
- Further, in the case where the parallel pipe internal thread is used, a packing is jointly used.

K 6770-1991  
Edition 1

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Japanese Text

Established by Minister of International Trade and Industry

Date of Establishment: 1991-02-01

Date of Public Notice in Official Gazette: 1991-02-26

Investigated by: Japanese Industrial Standards Committee

Divisional Council on High Polymer

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This English translation is published by:  
Japanese Standards Association  
1-24, Akasaka 4, Minato-ku,  
Tokyo 107 Japan  
© JSA, 1991

Printed in Tokyo by  
Hohbunsha Co., Ltd.